REMARKS

Claims 4, 7-8, 11-13, 15, 18 and 21-27 are all the claims presently pending in the application. Claim 4 has been amended to more clearly define the claimed invention. Claims 26 and 27 have been added.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Applicant gratefully acknowledges the Examiner's indication that claims 7-8, 11-13 and 24-25 are allowed. However, Applicant respectfully submits that all of the claims are in condition for immediate allowance.

Claims 4, 15, 18 and 21-23 stand rejected under 35 USC 103(a) as being allegedly unpatentable over Fukumoto et al. (USP 6,583,837) in view of Yamada et al. (USP6,344,883) further in view of Hsieh (USP 6,466,295).

This rejection is traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by claim 4) is directed to a liquid crystal display device. The device includes a first substrate on which a plurality of pixel electrodes are formed, a second substrate on which an opposing electrode is formed, a liquid crystal layer sandwiched between the first and second substrates, the second substrate further having thereon a plurality of protrusions, **each of the protrusions being** positioned at a substantially central portion of a corresponding one of the pixel electrodes and **elongated toward the first substrate,** and an alignment layer formed between the plurality of protrusions and the first substrate. The plurality of protrusions comprises a rod-shaped spacer extending between the first and second substrates.

Conventional liquid crystal display devices attempt to improve a viewing angle by including a cutout portion of the common electrode and alignment layer (Application at Figure 1A; page 2, lines 15-16). When a voltage is applied, the electric fields at the edges of the cutout are tilted such that each pixel is divided into two or more liquid crystal domains.

However, such conventional devices require additional processing steps and must be precisely positioned. (Application at page 3, lines 11-18).

The claimed invention, on the other hand, includes a second substrate having thereon a plurality of protrusions, **each of the protrusions being** positioned at a substantially central portion of a corresponding one of the pixel electrodes and **elongated toward the first substrate** (Application at page 12, lines 12-24; Figure 2A). With this novel feature, when a voltage is applied between the pixel electrodes and the opposing electrode, boundaries of liquid crystal domains in the liquid crystal layer may be accurately defined by the plurality of protrusions positioned at a substantially central portions of the corresponding one of the pixel electrodes formed on a first substrate and elongated toward the first substrate. Consequently, liquid crystal display devices having a high contrast ratio over a wide viewing angle with less or no gray scale inversion can be realized. In the liquid crystal display according to the claimed invention, this may produce a side or secondary benefit of increasing the response speed.

II. THE ALLEGED PRIOR ART REFERENCES

The Examiner alleges that Fukumoto would have been combined with Yamada and Hsieh to form the invention of claim 4, 15, 18 and 21-23. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest the features of the claimed invention.

Fukumoto discloses a liquid crystal display (LCD) device which includes protrusions 27 formed on a common electrode 21 of a color filter substrate 200 (Fukumoto at col. 5, lines 8-11).

Yamada discloses an LCD device having convex portions 66 formed on a substrate (Yamada at col. 25, lines 25-35).

Hsieh discloses a method of forming a spacer for an LCD device which includes a protrusion-spacer structure 25 formed on a substrate 20 (Hsieh at col. 5, lines 51-61).

Applicant respectfully submits that these alleged references are unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the alleged references provide no motivation or

suggestion to urge the combination as alleged by the Examiner. Indeed, these alleged references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the alleged references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Fukumoto, nor Yamada, nor Hsieh, nor any alleged combination thereof teaches or suggests a "*second substrate further having thereon a plurality of protrusions, each of said protrusions being positioned at a substantially central portion of a corresponding one of said pixel electrodes and* ***elongated toward the first substrate***", as recited in claim 4.

As noted above, with this novel feature, when a voltage is applied between the pixel electrodes and the opposing electrode, boundaries of liquid crystal domains in the liquid crystal layer may be accurately defined by the plurality of protrusions positioned at a substantially central portions of the corresponding one of the pixel electrodes formed on a first substrate and elongated toward the first substrate. Consequently, liquid crystal display devices having a high contrast ratio over a wide viewing angle with less or no gray scale inversion can be realized. In the liquid crystal display according to the claimed invention, this may produce a side or secondary benefit of increasing the response speed.

Clearly, the cited references neither teach nor suggest the subject features in the independent claim 4 of the present patent application.

The Examiner alleges that Fukumoto et al. disclose upper and lower substrates with protrusions 27 corresponding to the central portions of the pixel electrode 13 and liquid crystal material disposed between the substrates.

However, Fukumoto et al. does not teach or suggest that each protrusion is positioned at a substantially central portion of a corresponding one of pixel electrodes and **elongated toward the first substrate**. Likewise, Fukumoto does not teach or suggest a plurality of protrusions that include a rod-shaped spacer extending between first and second substrates, as recited in claim 4.

Indeed, the protrusions 27 taught by Fukumoto et al. are a part of projected portions 241 formed on a color filter substrate 200. Protrusion 25, 26 and 27 are formed, in addition to a protrusion 22. These protrusions 22, 25, 26 and 27 are mutually connected into a unitary

form (see column 5, lines 7-12 and 28-30). The protrusions 27 are elongated from the protrusion 22 **in direction parallel to the surface of the substrate 200.** The thickness of the protrusions 27 in the direction perpendicular to the substrate 200 is same as that of protrusions 22 in the direction perpendicular to the substrate 200, because these protrusions 22 and 27 are made up of same layer formed on the substrate 200. Consequently, the above feature in the claim 4 is not disclosed in the Fukumoto reference.

The Examiner further alleges that Yamada et al. disclose a liquid crystal display device and method of producing the same where in FIG. 12A, rod shaped spacers are labeled as 65 and a substrate is labeled as 62. The Examiner further alleges that Yamada et al. disclose in FIG. 29 where an alignment layer 68 extends between spacer 65 and substrate.

However, Yamada et al. does not teach or suggest that each of protrusion is positioned at a substantially central portion of a corresponding one of pixel electrodes and elongated toward the first substrate, as recited in claim 4. Indeed, the spacers 65 taught by Yamada et al. are formed on convex portions 66 which is formed on a regions other than pixel regions of a substrate 62 (See column 25, lines 26-34, and FIG. 12B). That is, the convex portions 36 are located **so as to surround the pixel regions,** as shown in FIG. 1A (see column 13, lines 37-39). Therefore, the spacers 65 taught by Yamada et al. are **located on a regions other than pixel regions**.

Consequently, the Yamada reference clearly does not teach or suggest that each protrusion is positioned at **a substantially central portion of a corresponding one of pixel electrodes** and elongated toward the first substrate. Therefore, Yamada does not make up for the deficiencies in Fukumoto.

As to the Hsieh reference, the Examiner alleges that Hsieh discloses a method of forming a spacer for liquid crystal display devices where in FIG. 2C, element 25 is a spacer/protrusion and in FIG. 3D element 35 is a spacer/protrusion.

However, Hsieh does not teach or suggest that each of protrusion is positioned at a substantially central portion of a corresponding one of pixel electrodes and elongated toward the first substrate, as recited in claim 4. The spacers 35b taught by Hsieh are formed on a black matrix 35a, as shown in FIG. 3D (see column 6, lines 35-40). The spacers 35b are clearly located outside of pixel electrode matrix 38, because they are located on the black matrix 35a. The spacers 25b taught by Hsieh are formed on a color filter film 22, as shown in

FIG. 2C (see column 5, lines 7-9 and 46-50). In FIG. 2D, the spacers 25b are depicted as being in contact with pixel electrode matrix 28.

However, there is no intentional disclosure that **each protrusion is positioned at a substantially central portion of a corresponding one of pixel electrodes.** Moreover, there is no disclosure why each of protrusion should be positioned at a substantially central portion of a corresponding one of pixel electrodes. Therefore, even if the skilled in the art would have encountered the Hsieh reference, the motivation would not be raised to form **each protrusion positioned at a substantially central portion of a corresponding one of pixel electrodes.**

Further, the spacers taught by Yamada et al. and Hsieh serves as spacers for keeping a cell gap between two substrates to form the liquid crystal panel. To the contrary, the protrusions 27 taught by Fukumoto et al. do not serve as spacers for keeping a cell gap between two substrates to form the liquid crystal panel. Instead, the protrusions 27 are simply protruding portions projecting from the protrusion 22 in direction parallel to the surface of the substrate 200. Further, the protrusions taught by Fukumoto et al. are formed to eliminate a disclination line in the pixel regions. Therefore, the structure taught by Fukumoto et al. cannot be combined with the structure taught by Yamada et al. or Hsieh, because the **protrusions 27 taught by Fukumoto et al. cannot be replaced with the spacers taught by Yamada et al. or Hsieh.**

Further, even assuming (arguendo) that the disclosure taught by Yamada el al. would have been forced somehow to be combined with the structure taught by Fukumoto el al., the spacers taught by Yamada et al. are formed and located on a region other than pixel electrodes 13 taught by Fukumoto et al, based on the technical disclosure of Yamada el al. In addition, the spacers in Yamada et al. are located outside of the protrusions.

Moreover, even assuming (arguendo) that the disclosure taught by Hsieh would have been forced somehow to be combined with the structure taught by Fukumoto et al., the spacers taught by Hsieh are formed and located on a layer 211 comprising a black matrix and colored layer of RGB (see column 8, lines 9-14) taught by Fukumoto et al., based on the technical disclosure of Hsieh. The layer 211 comprising the black matrix and the colored layer of RGB is simply depicted as a single layer provided on a color filter substrate 201. Therefore, the locations will be not fixed where the spacer should be located. In addition, the

spacers are located outside of the protrusions 27. Therefore, the protrusions do not comprise any spacer extending between two substrates.

Consequently, even if these cited references would have been combined, as alleged by the Examiner, the features of claim 4 could not have been obtained. Thus, one skilled in the art would not have reached any conception from allegedly combining the cited references to modify Fukumoto to form the invention of claim 4.

Therefore, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest the features of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 4, 7-8, 11-13, 15, 18 and 21-27, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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